NERRS Science Collaborative Progress Report for the Period September 1, 2011 through February 28, 2012

Project Title: Carbon Management in Coastal Wetlands: Quantifying Carbon Storage and Greenhouse Gas Emissions by Tidal Wetlands to Support Development of a Greenhouse Gas Protocol and Economic Assessment

Principal Investigator(s): Alison Leschen, Project Coordinator, Manager of the Waquoit Bay National Estuarine Research Reserve (WBNERR)

Project start date: November 15, 2012

Report compiled by: Tonna-Marie Rogers, Collaboration Lead

Contributing team members and their role in the project:
- Jim Tang (for Applied Science Investigators)
- Omar Abdul-Aziz (Modeler)
- Steve Emmett-Mattox, Restore America's Estuaries (Intended User Representative)
- Thomas Walker (Manomet Center for Conservation Sciences (Intended User Representative)
- Jordan Mora (GIS/Field technician, WBNERR staff member)
- James Rassman (Field research support staff, Stewardship Coordinator, WBNERR)
- Tonna-Marie Rogers (Collaboration Lead, CTP Coordinator, WBNERR)

A. Progress Overview

This project is designed to address the interaction of two of the most critical management issues currently facing coastal communities, climate change and eutrophication caused by excess nitrogen loading. The goals of the project are to:

1. Quantify carbon sinks and GHG fluxes (both production and consumption) in tidal wetlands, and assess the impact of anthropogenic nitrogen loading, sea level rise, and climate on both carbon sequestration and net GHG emissions in tidal wetlands.

2. Develop a carbon sequestration and GHG emissions model for tidal wetlands using the collaboration between end-users and scientists to identify the specific data needs for it, and apply the model to aid the development of a tidal wetlands GHG offset protocol.

3. Connect the conservation community with guidance on management of carbon and nitrogen and with carbon markets by providing a GHG offset protocol (methodology) that will be adopted by climate registries.

4. Provide to intended users (resource managers, project developers, policymakers, land use planners, and those involved with carbon markets) data and a GHG offset model that can inform planning for tidal wetlands preservation and restoration (particularly regarding N loading and sea level rise), and climate change mitigation / adaptation.

E. Conduct an economic assessment of the carbon sequestration and GHG benefits of tidal wetlands, including the impact of nitrogen loading, to assess the financial relevance to land conservation decisions.

F. Advance the ability of the NERRS, building on its System-Wide Monitoring Program, Biomonitoring and Sentinel Site efforts, to monitor the effects of climate change on coastal ecosystems.

This first quarter of project implementation represented our start-up phase. As part of start-up activities our team focused on six main tasks as outlined in the project proposal timeline: (i) convening a project kick-off meeting to better familiarize core team members with each component of the project and discuss how we could best work together going forward, (ii) identifying and agreeing on specific objectives for engaging with intended users and a strategy for connecting with them, (iii) selecting research sites, securing field equipment, and mapping out a sampling strategy and field infrastructure needs, (iv) developing a draft wetlands GHG offset methodology, (v) issuing sub-awards through our Fiscal Agent, the National Estuarine Research Reserve Association (NERRA), and (vi) hiring field support staff as well as a Collaboration Assistant. Tasks I-IV have been accomplished and Tasks V and VI are almost complete.

B. Working with Intended Users:

As part of developing a strategy for integrating the perspectives of intended users into the research process the Collaborative Lead organized and facilitated a 1.5 day kick-off planning meeting for the project team. The original intent for this meeting was to include a broader group of intended users *(other than those represented on the project team)* and stakeholder representatives in team discussions. This plan was modified after an initial planning call with team members. Given the complexity of our project and the various components involved we felt it would be more beneficial at this start-up phase to use the kick-off meeting to go through each component of the project in depth with team members, unpack tasks and needs, agree on the intended users and stakeholders we needed to connect with and how best to engage them, and plan for the next six months. The objectives and results of the kick-off meeting are discussed more fully in Section C.

As part of the kick-off meeting the team discussed and identified opportunities to involve intended users throughout the course of the project. In order to familiarize team members with the collaborative learning methodology that will be used to better link the project with user needs and perspectives, the Collaborative Lead arranged for Dr. Chris Feurt, CTP Coordinator at the Wells Reserve, to provide a lecture to team members on the collaborative learning framework. Using the lecture as a launching point the team agreed on an initial approach for integrating user perspectives into the project over the next few months.

Our first formal interaction with users and stakeholders will take the form of a collaborative learning workshop/stakeholder engagement meeting that will occur on March 28 and 29, 2011 at WBNERR. Prior to the project kick-off meeting, the Collaboration Lead had requested support from the NERRS Science Collaborative to convene a workshop on collaborative learning for project team members. This workshop will be led by Dr. Chris Feurt. The decision was made to utilize this training opportunity to actually discuss our project with intended users and stakeholders thereby increasing the power of the training for the project team. This approach also has the added value of providing a benefit to the intended users and stakeholders that will attend as they will receive training on a collaborative process that they can apply in their own work. As part of the training/meeting agenda, we intend to work with intended users to identify how best to engage with them over the life of the project as well as barriers to, and incentives for, working with us. The Collaboration Lead will work with Dr. Feurt, Dolores Leonard at the NERRS Science Collaborative, and other team members to modify the workshop agenda to meet our objectives. In preparation for this workshop the Collaboration Lead will hold interviews with team members and intended user representatives. Information gathered from these interviews will provide the background for discussion at the meeting. In addition, the Collaborative Lead will work with the project team to prioritize a list of key questions/issues

related to the four main components of the project to gather input on. These questions will relate to our research questions and plans, development of the GHG methodology and user friendly model as well as the economic and policy analyses. Input gathered from intended users at this workshop will form the basis for planning follow-up engagement opportunities over the course of the next six months to continue and strengthen the collaboration with them.

While the project kick-off meeting was carried out differently than originally envisioned, the revised approach turned out to be a better one and has helped to build cohesion between team members and the various components of the project. It has also increased familiarity of all team members with the collaborative learning process as well the NERRS Science Collaborative views of collaboration. This will be critical to ensuring the success of the collaboration goals of the project. This approach has also paved the way for more streamlined interaction with intended users and stakeholders going forward.

In preparation for carrying out the collaboration component of the work the Waquoit Bay National Estuarine Research Reserve has initiated hiring of an assistant to work with the Collaboration Lead/Reserve Coastal Training Coordinator. A position description has been developed and advertised. Prospective candidates will be interviewed in early March.

C. Progress on project objectives for this reporting period:

Project Kick-off Meeting

This meeting was held on February 7 and 8 at the Waquoit Bay Reserve headquarters. In attendance were: Alison Leschen, Jim Tang, Serena Moseman-Valtierra, Chris Weidman, Jordan Mora, James Rassman, Rebecca Roth, Steve Emmett- Mattox, Steve Crooks, Thomas Walker, Omar Abdul-Aziz, Tonna-Marie Rogers and Chris Feurt (guest presenter). Kevin Kroeger was ill and could not attend. The objectives of the kick-off meeting were to:

(i)   Allow core project personnel to meet face to face and go over roles and responsibilities.
(ii) Discuss and increase familiarity of all project partners with each component of the project and how they all fit together.
(iii) Agree on specific goals for engaging stakeholders and intended users of the science.
(iv) Discuss and agree on the collaborative learning process that will be utilized to garner input from stakeholders and intended users.
(v) Identify key stakeholders and intended users working at national, regional and local scales and opportunities to bring them into the research process.
(vi) Identify next steps and main tasks to accomplish in 2012.

Team members leading various aspects of the project each prepared and provided a briefing to the full project team. Each team member addressed the following areas in their briefing:
• primary research questions to be investigated
• tasks to be completed
• data, information and equipment needs
• integration points with other project components
• opportunities and potential occasions where stakeholder input would be necessary and highly beneficial
• plans for the next six months

Each presentation was followed by in-depth group discussion. These discussion periods were used to identify where clarification and coordination was needed among various sub-teams and particular stages in the project where we needed to get the perspectives of intended users. Action items were also identified and captured in the meeting notes. Below is a summary of the work that has been done on various aspects of the project and progress made to date.

Science Investigation and Field Research:

Since November 2011, the science investigators met several times and clarified roles and identified specific tasks to be done. Jordan Mora was hired by the Reserve to serve as the GIS/Field Research Technician.

Several meetings have been held to discuss the selection of ideal field sites. In November, the science investigators met with Alison Leschen and James Rassman to discuss infrastructure needs for the Sage Lot salt marsh which has been identified as the "pristine" site for the study. In this meeting the necessity and placement of a boardwalk and platforms for greenhouse gas flux measurements was raised. In January, the science investigators and Reserve staff (Chris Weidman, James Rassman and Jordan Mora) selected three additional sites which fall within a nitrogen load gradient (low, mid and high nitrogen levels). Soil and plant samples were taken from these sites to measure carbon and nitrogen content. The science team intends to develop salinity gradient plots and plant composition gradient plots at the pristine site in order to characterize the effect of salinity and species mix on GHG flux.

Site selection discussions and field visits continued through February. At the kick-off meeting several issues were discussed regarding appropriateness of sites and the type of information needed to be collected in the field to feed into development of the GHG methodology, the model and the economic and policy analyses. Following the kick-off meeting discussion on the type of field sites needed to allow examination of nitrogen loading effects on GHG fluxes was revisited and roughly forty potential sites were selected within the larger Waquoit Bay system and neighboring estuaries. These sites were analyzed based on certain physical and biological criteria during a meeting held on February 16, and the list was narrowed to eleven. These eleven sites are being compared based on channel drainage characteristics (including water depth, temperature, salinity, and pH during high and low tide), nitrogen load (both in terms of groundwater input and tidal water input), and plant community. The goal is to eventually select three sites with low to high nitrogen levels which are easy to access, have similar vegetation communities, and contain enough water chemistry variation in the outgoing and incoming tides that a concentration gradient can be measured. Once these sites are approved, field measurements will begin depending on equipment availability and infrastructural support (i.e., completion of boardwalk construction).

During the project kick-off meeting, questions were also raised regarding which physical and biological variables should be measured in the field and what methodology would be used to collect that data. Although the GHG vertical and lateral flux measurements were well-outlined in the original proposal, additional soil and plant properties were highlighted at the meeting as significant indicators which will be necessary to feed into the ecosystem-based model and economic assessment. Based on these conversations and follow-up discussions, the field scientists have compiled a list of parameters which will likely be measured over the course of two years and that will match up with the needs of investigators working on the model, GHG methodology and economic assessment. The draft research plan that has been developed will

be discussed with intended users and stakeholders at the stakeholder engagement meeting in March to gain input.

In late February science investigators, Reserve research and stewardship staff, and representatives from the University of Rhode Island (URI) and the National Geodetic Survey (NGS) office discussed digital elevation modeling at Sage Lot marsh (pristine site) to characterize water flow from the marsh. This information will be critical to know to direct appropriate placement of instrumentation in the field for lateral GHG flux measurements. The University of Rhode Island and the NGS have agreed to conduct the fieldwork necessary for digital elevation modeling.

In addition to the preliminary activities to prepare for the start of field research, the science team also made progress on acquiring field equipment. After carefully comparing manufacturers, the NO2 analyzer was ordered from Los Gatos Inc. and the CO2/CH4 analyzer from Picarro, Inc. A chamber system that can connect to these two analyzers will be designed within the six months.

GHG Methodology

Restore America's Estuaries is moving forward with development of a draft wetlands greenhouse gas offset methodology for adoption by the Verified Carbon Standard (VCS). RAE has contracted with its lead consultants, Steve Crooks and Igino Emmer (Silvestrum), and secured participation from other science experts Pat Megonigal (Smithsonian Environmental Research Center) and Doug Myers (People for Puget Sound). RAE anticipates completion of a draft methodology by June 2012, and will then submit the draft to two independent, VCS-approved validators.

Biogeochemical Model

Analysis of wetland biogeochemical similitudes and scaling was proposed by Omar Abdul-Aziz as the first step to developing a simple, user-friendly model to robustly predict wetland GHG emissions and carbon sequestration under changing climate and land use scenarios. A preliminary version of the theoretical model framework was developed. Model results will be tested with observed data collected from field studies at WBNERR sites in the next six months.

Economic and Policy Analysis

Tom Walker prepared a briefing for the project team on the economic and policy assessment to be done as part of this project. He provided an overview of the objectives for this analysis and key issues and questions that the team needed to address to help direct the work. Some of the questions raised through this exercise will be posed to intended users at the workshop in March as a means of gathering input on how best to tailor the economic and policy analyses to make the results more applicable to intended users and communities in Massachusetts.

Sub-Awards

Sub-awards are being finalized with NERRA and the following organizations: the Citizens for the Protection of Waquoit Bay, the Marine Biological Laboratory, the United States Geological Survey, Florida International University, the University of Rhode Island, Manomet Center for Conservation Sciences and Restore America's Estuaries.

Team Coordination and Project Communication

The project team has begun using Basecamp as a communication and project management tool. At the kick-off meeting the team also discussed and agreed on other activities to ensure regular communication among sub-teams working on various aspects of the project. The team will hold monthly conference calls to start and will share information about the project through the WBNERR and the NERRS Science Collaborative websites. We will seek to create a separate page on the WBNERR site for this project and use this as our primary web presence. Other organizations involved in the project will create links to this page on their respective sites.

D.   Benefit to NERRS and NOAA: List any project-related products, accomplishments, or discoveries that may be of interest to scientists or managers working on similar issues, your peers in the NERRS, or to NOAA. These may include, but are not limited to, workshops, trainings, or webinars; expert speakers; new publications; and new partnerships or key findings related to collaboration or applied science.

Regarding development of a user friendly biogeochemical model, biogeochemical similitudes and scaling is a new concept proposed for identifying wetland biogeochemical emergence (or similarity patterns) pertaining to GHG emissions and sequestered carbon. It is a novel idea that can potentially reshape the study of ecosystem carbon dynamics. An Excel spreadsheet format of the proposed and tested model will eventually be developed so that someone with a working knowledge of Excel can predict major GHGs and sequestered carbon from the tidal wetland ecosystems across a range of seasonal and spatial settings.

E.   Describe any activities, products, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for the Science Collaborative to know.

There are no items to report for this section.